more has been observed in the United States fifteen times during the past twenty-six years. In some cases the velocity of the spirally inflowing winds must actually be less than the progressive movement of the disturbance as a whole. This was probably true on the following occasions when the mean velocity of the cyclone center exceeded 70 miles an hour:

December 26–28, 1880, 75 miles an hour; February 1, 1881, 75 miles an hour; February 8–9, 1884, 81 miles an hour; December 21–22, 1884, 79 miles an hour; February 21, 1894, 75 miles an hour.

These are average velocities for the whole path of the storm, but the rate is never uniform, and no doubt at times the speed of these storms was even greater. Hann states that the maximum velocities known to him for Europe are—

December 16, 1869, and November 10–11, 1875, 70 miles an hour; March 12–13, 1876, at Hamburg, 76 miles an hour.

The average velocity of anticyclones is a matter of not less importance, but the values found are not so certain on account of the difficulty of fixing exactly the centers of high pressure areas. The data in the Monthly Weather Review enable us to calculate the mean rate of movement for the period of only sixteen years from 1888 to 1904. The results will be found in Table 2, mean velocities and number of anticyclones in the United States, 1888–1904. The annual mean is 25.6 miles an hour, which is only 10 per cent less than the speed of cyclones. The maximum velocity is found in January, 29.5 miles, and the minimum in August, 22.1 miles. The maximum velocity of anticyclones rarely exceeds 60 miles an hour.

A COURSE IN DYNAMIC METEOROLOGY.

Dr. Arthur Schuster, the eminent professor of physics in Owen's College, Victoria University, Manchester, England, has contributed funds for the maintenance of a readership in dynamic meteorology at some university in the British Isles. The appointment to this position seems to have been intrusted to the Meteorological Committee of the Royal Society, and the first incumbent is to be Mr. Ernest Gold, M. A., Fellow of Saint John's College, and superintendent of instruments in the Meteorological Office at London. He will hold this position for three years, or until October, 1910.

Meteorology owes a debt of gratitude to Professor Schuster for the first recognition of dynamic meteorology, or the mechanics of the earth's atmosphere, as a subject worthy of special recognition by British universities. Will not some American patron of science do as much for an American university?—*C. A.*

WEIGHT OF SLEET ON TELEGRAPH WIRES AND TREES.

Mr. P. H. Smyth, Local Forecaster, sends the following extract from the daily journal of the Cairo, Ill., station, for the date January 30, 1902:

> In order to give an idea of the thickness of ice on branches of trees the following illustration is given: A twig measuring 23½ inches in length, tapering from $\frac{5}{16}$ of an inch to ⅛ of an inch in diameter, and weighing ⅝ of an ounce, was incased in ice weighing, when melted, 12¾ ounces, troy weight. The twig was obtained before any melting of ice had taken place.

ON THE DEPRESSION IN THE VALUE OF THE TOTAL INTENSITY OF THE SOLAR RADIATION IN 1903, ACCORDING TO MEASUREMENTS MADE AT THE CENTRAL STATION OF THE POLISH METEOROLOGICAL SERVICE AT WARSAW.

By Ladislaus Gorczyński, D. Sc. Dated Vienna, Austria, February 8, 1907.

[Translated by Chester L. Mills.]

INTRODUCTION.

In the Monthly Weather Review (Vol. XXXII, No. 3, pp. 111–112, 1904) was reproduced a note published by us in the Comptes Rendus of the Academy of Science of Paris (T. 138, 1904, pp. 225–258) on the subject of a considerable diminution in the total value of the intensity of solar radiation, determined at Warsaw by measurements made regularly since 1901 at the Central Station of the Polish Meteorological Service.

This short note, of a provisional character, necessarily requires correction and completion in order to accord with the results of five years of measurements (1901–1905); especially the numerical values formerly given for the years 1901, 1902, and 1903 at Warsaw, have been recognized as not being correctly exprest in gram-calories, because of a mistake in the old theory of the Ångström-Chwolson type of actinometer. That mistake consists, as the results recently acquired show, in the inadequacy of converting actinometric measures by means of an instrumental "constant". This source of error is very important, and we shall speak of it further on. (See section 1.)

In a work[1] recently published there are discust the results of five years' measurements (1901–1905) at Warsaw, which were definitely reduced to gram-calories, in accordance with the modified theory, by means of variable coefficients of transmission established by numerous comparisons with the electrical compensation pyrheliometer. We took advantage of that occasion to communicate, in an extract, the newly established results on the subject of the march of the solar depression at Warsaw; these results should replace those of the preceding note, published in 1904 in the Monthly Weather Review.

This communication having the character of a monograph, and referring only to Warsaw, we shall occupy ourselves here neither with the literature[2] of the question nor with the important measurements which have been made in other places. We shall only recall that the diminution of solar radiation of which we shall speak was observed, independently, in Europe by M. H. Dufour and in America by Mr. H. H. Kimball. It appears now that Mr. Kimball was the first to observe the fact of the depression, altho the first notice published on the subject belongs to M. Dufour.

1. *Apparatus.*—In the following measurements at Warsaw, an actinometer of the Ångström-Chwolson type was used, which was constructed in 1893 by Prof. O. Chwolson, and described in detail in an important memoir under the title, "Actinometrische Untersuchungen zur Construction eines Actinometers und eines Pyrheliometers" (Wild's Repertorium für Meteorologie. Vol. 16, No. 5, 1893).[3] This instrument (see fig. 1, Ångström-Chwolson actinometer, type of 1893) belongs to the so-called dynamic type of actinometers; it is based on the method employed in 1887, by Prof. K. Ångström. The essential point of the latter method consists in the simultaneous measurement of the differences of temperature between two identical bodies, one of which is exposed to the sun while the other is in the shade (and vice versa).

The definitive formula for the actinometer of the Ångström-Chwolson system is of form:

$$q = K\omega \qquad (1)$$

$$\text{where } K = \frac{2c}{s} \qquad (2)$$

$$\omega = \frac{1}{t}\,\frac{\theta_2^{\,2} - \theta_1\,\theta_3}{\theta_1 - \theta_3} \qquad (3)$$

where q = *the intensity of the solar radiation referred to a* unit of surface exposed normally; c = the thermal capacity;

[1] Lad. Gorczyński. Sur la marche annuelle de l'intensité du rayonnement solaire à Varsovie et sur la théorie des appareils employés. 8vo., VIII, 202 pages, with 2 plates, 1906. (Wende and Co., Booksellers, Warsaw.)

[2] That literature may be found in the works of Messrs. H. H. Kimball, S. P. Langley, H. Dufour, R. Holm, etc., also in our own work of 1906, cited above.

[3] See also Weather Bureau Bulletin No. 11, pp. 721–725.

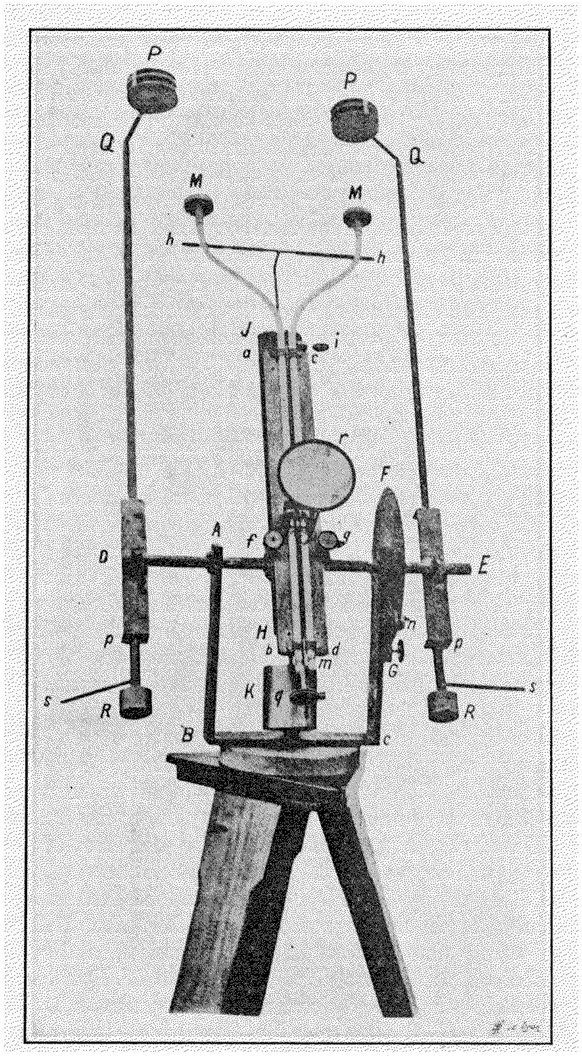

FIG. 1.—The Ångström-Chwolson actinometer, type of 1893.

s = the absorbing surface; θ_1, θ_2, θ_3, simultaneous differences of temperature of the two bodies in the equal successive intervals of time t. We shall designate by T the excess of temperature of the body over that of the surrounding medium; by h the coefficient of external thermal conductivity; by d the thickness of the glass envelop of the actinometric body; and by k the coefficient of internal thermal conductivity. The formula (1) (where, according to the old theory, K represents a "constant" for each instrument, whereas the value of ω is calculated directly for each measurement and has been considered as a relative value of the radiation) is now obtained by the integration of the differential equations:

$$qsdt = cdT + shTdt \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

for the case of a body warming up under the action of the sun, and

$$0 = cdT + shTdt \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

for the cases of a body cooling in the shade, assuming in both cases that the respective losses of heat (exprest by the last factors of the formulas) are identical for equal values of T.

This supposition, however, is not exact, if, as was done here, one takes the values of T directly from the readings of the actinometric thermometers. Knowing the complicated special structure of the actinometric bodies of the instrument in question, we ought not to identify the thermometric state of the mass of mercury with that of the blackened surfaces which absorb the solar radiation; it must not, then, be assumed that at the moment when the columns of mercury have the same positions in the two actinometric thermometers, the temperatures, and therefore the losses of heat, are at that moment equal for all parts of the apparatus, i. e., for the two bodies in general.

2. *Modified formulas and comparisons of the actinometers with the electrical compensation pyrheliometer.*—In order to modify the formulas of the old theory let us designate by ψ the difference between the temperature of the body that is being warmed and that of the mercury within, and by φ the corresponding difference for the cooling surface and that of the mercury within it:

Instead of the equations (4) and (5) we shall have

$$qsdt = cdT + sh(T+\psi)dt \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

and

$$0 = cdT + sh(T-\varphi)dt \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

For ψ and φ the following relations have been established:[4]

$$\psi = \frac{d}{k+hd} \cdot (q - hT) \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

$$\varphi = \frac{hd}{k+hd} \cdot T \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Introducing these values in (6) and (7) we obtain:

$$qsdt = c\left(1 + h\frac{d}{k}\right) dT + shTdt \ldots\ldots\ldots\ldots (10)$$

$$0 = c\left(1 + h\frac{d}{k}\right) dT + shTdt \ldots\ldots\ldots\ldots (11)$$

where the values of T relate directly to the temperatures indicated by the actinometric thermometers.

The definite formulas of the modified theory may therefore be written in the form:[5]

$$q = K'\omega \ldots\ldots\ldots\ldots\ldots\ldots (12)$$

where the value of ω (which is obtained directly from each actinometric measurement) is identical with that of the old theory [see formula (3)], whereas the factor

$$K' = \frac{2c}{s}\left(1 + h\frac{d}{k}\right) \ldots\ldots\ldots\ldots\ldots\ldots (13)$$

no longer represents an "instrumental constant", but a coefficient of transmission varying with h. By reason of the increase of h with the temperature we may expect that the values of the coefficient K' will, in the course of the year, represent certain variations in this function of the temperature. We may consider these variations as corresponding also approximately to those of the intensity of solar radiation.

The theoretical hypotheses concerning the character and the variations of the coefficient of transmission of the actinometer of the Ångström-Chwolson type are completely confirmed by direct comparisons with the electrical compensation pyrheliometer.[6] At Warsaw during the period 1901–1905, in 78 days of observation, 1023 pyrheliometric measurements were made, and by comparing the simultaneous values given by the two instruments the following coefficients have been obtained[7] (averages arranged in groups):

(*a*) Ångström-Chwolson actinometer No. 44, 29:				
"Relative" value for this actinometer	1.02	1.15	1.25	1.32
Coefficient of transmission	0.811	0.844	0.863	0.882
(*b*) Ångström-Chwolson actinometer No. 60, 57:				
"Relative" value for this actinometer	......	1.11	1.37	1.63
Coefficient of transmission	......	0.737	0.744	0.750

The variability of the coefficient of transmission is not the same in these two cases, the values of d and k not being necessarily the same for each instrument.

[4] See the author's work above cited (1906); Chap. II, pp. 19–22; in what follows we shall designate this work by the abbreviation: G. 1906.

[5] Note that the value of h is considered as a constant during a single measurement with the actinometer of the Ångström-Chwolson type.

[6] A description of the electrical compensation pyrheliometer (with figure) may be found in the Monthly Weather Review (July, 1903, Vol. XXXI, pp. 320–334; and October, 1901, Vol. XXIX, pp. 454–458).

[7] See G., 1906, Chap. VI, pp. 89–98.

3. *Actinometric data for Warsaw and their degree of precision.*—The actinometric data obtained at Warsaw consist of 7622 measurements made during 389 days of observation (in the period 1901–1905). The instruments were installed on the upper terrace of the Central Meteorological Station, situated 25 meters above the average level of the adjacent streets; the elevation of the place of observation above the level of the sea does not exceed 130 meters.

From all the actinometric measurements we have computed 864 "definitive" values, each of which is the mean of five consecutive values converted into absolute values by means of the coefficient of transmission.

A critical discussion of the errors entering into the measurements at Warsaw[8] leads to the conclusion that the accidental errors of the "definitive" values do not, in general, exceed 1 per cent of the measured value of the solar radiation. As to the systematic error common to the whole series of measurements, it is identical with that of the pyrheliometer that was taken as a standard. As a maximum value of this latter error, according to Prof. K. Ångström, we may take 1.4 per cent.

These results show that the actinometer constructed by Prof. O. Chwolson is justly placed among the instruments of precision, and may be properly used in current measurements of the total intensity of the solar radiation.

For each value of the intensity of radiation we have calculated the corresponding elevation of the sun, likewise the absolute humidity in millimeters observed by means of the aspiration psychrometer of Assmann.

The variations (ΔQ) in the intensity of radiation with the angular altitude of the sun (h) at Warsaw have been found to be as follows:[9]

h	ΔQ	h	ΔQ
9°–12°	0.119	25°–30°	0.066
12°–15°	0.093	30°–35°	0.061
15°–20°	0.108	35°–45°	0.074
20°–25°	0.087	45°–55°	0.054

We observe that these variations, which have been utilized for the reduction to the [adopted standard] height of the sun at Warsaw, correspond to the analogous variations found for Treurenberg (in Spitzbergen), for Zakopane (in Galicia, Austrian Poland), and for Guimar (on the Island of Teneriffe).

4. *Annual summaries of the measurements of the intensity of solar radiation at Warsaw.*—In approaching the question of the diminution in the intensity of the solar radiation in 1903, we must first of all tabulate the summaries for the five consecutive years of the period 1901–1905, as follows:

In Table 1 are given, in consecutive columns, separately for each year, the following:

1. Year and month (in Roman numerals I–XII).
2. Mean monthly values of Q, calculated from tables *in extenso*[10].
3. Elevation (h) of the sun at the middle of each month, at Warsaw.

TABLE 1.—*Annual summaries, Warsaw, 1901–1905.*

1	2	3	4	5	6	7	
Year and month.	Monthly mean. Q	h	Q 30°; mean distance.	n	f	Monthly Max. Q	Date.
1901.		°					
I	0.820	17	1.001	4	3.9	0.881	27
II	1.132	25	1.172	6	2.2	1.242	12
III	1.083	36	1.010	5	4.8	1.139	31
IV	1.225	47	1.089	7	5.7	1.320	8
V	1.209	56	1.043	16	7.5	1.346	2
VI	1.185	61	1.014	7	13.3	1.294	14
VII	1.188	59	1.025	12	11.3	1.269	4
VIII	1.120	51	0.978	8	12.4	1.259	11
IX	1.158	41	1.058	9	9.5	1.241	25
X	1.076	29	1.082	6	8.7	1.199	22
XI	1.002	20	1.129	2	3.6	1.049	10
XII	0.944	15	1.167	3	5.6	0.975	6
Mean	....	....	1.052	85	8.3	....	.....
1902.							
I	0.826	17	1.009	3	4.0	0.859	25
II	1.014	25	1.060	5	3.2	1.134	22
III	1.169	36	1.093	4	4.2	1.324	13
IV	1.182	47	1.046	5	4.4	1.278	21
V	1.098	56	0.933	6	6.4	1.155	24
VI	1.114	61	0.940	7	7.6	1.177	4
VII	1.177	59	1.011	7	8.2	1.328	29
VIII	1.110	51	0.965	8	9.3	1.269	23
IX	1.171	41	1.071	6	7.3	1.367	20
X	0.997	29	1.003	4	4.4	1.125	5
XI	0.845	20	0.976	8	3.0	0.942	19
XII	0.661	15	0.894	5	1.9	0.722	8
Mean	....	....	0.994	68	5.7	....	.....
1903.							
I	0.729	17	0.909	2	1.8	0.744	14
II	0.800	25	0.850	5	3.9	0.838	15
III	0.919	36	0.849	6	6.1	0.977	3
IV	1.005	47	0.869	1	5.5	1.005	22
V	0.964	56	0.793	5	7.9	1.011	22
VI	1.140	61	0.967	2	9.5	1.187	30
VII	1.023	59	0.852	3	10.6	1.144	28
VIII	0.988	51	0.839	3	12.0	0.998	22
IX	0.981	41	0.885	8	8.9	1.011	19
X	0.890	29	0.898	5	7.4	1.017	27
XI	....	20	....	....	....	....	.....
XII	(0.480)	15	0.716	1	2.1	....	.....
Mean	....	....	0.862	41	7.3	....	.....
1904.							
I	0.640	17	0.825	5	2.4	0.715	1
II	0.750	25	0.800	4	4.3	0.917	23
III	1.171	36	1.094	7	2.5	1.256	4
IV	1.155	47	1.020	4	5.5	1.210	29
V	1.136	56	0.975	12	5.9	1.821	21
VI	1.094	61	0.919	14	6.8	1.190	13
VII	1.122	59	0.956	8	7.6	1.313	13
VIII	1.108	51	0.963	8	8.4	1.193	29
IX	1.146	41	1.050	12	7.0	1.238	13
X	0.985	29	0.993	4	6.7	1.150	24
XI	0.975	20	1.104	2	3.0	1.006	16
XII	0.772	15	1.003	2	2.4	0.796	28
Mean	....	....	0.968	82	6.9	....	.....
1905.							
I	0.833	17	1.013	7	2.0	0.937	18
II	1.123	25	1.161	1	2.7	1.123	5
III	1.114	36	1.036	2	5.1	1.129	13
IV	1.139	47	1.004	3	6.5	1.264	24
V	1.166	56	1.000	14	7.7	1.266	6
VI	1.090	61	0.915	4	12.7	1.142	2
VII	1.200	59	1.036	8	10.5	1.295	18
VIII	1.139	51	0.997	7	10.9	1.204	3
IX	1.179	41	1.085	5	8.4	1.316	20
X	1.157	29	1.130	1	5.4	1.157	10
XI	0.866	20	0.997	3	5.5	0.890	29
XII	0.828	15	1.056	2	3.9	0.831	14
Mean	....	....	1.016	57	8.0	....	.....

4. Mean monthly Q, reduced to the elevation of 30° and to the mean distance of the earth, as the adopted standard for the whole series of months.
5. Number (n) of days of observation that have been used for the formation of the mean Q; these numbers were at the same time considered as the "weights" for the corresponding monthly averages.
6. Mean of the absolute humidity f expressed in millimeters for the days of observation and for the time corresponding to the diurnal[11] value of the intensity.
7. In the last column are indicated the highest values for each month, also their respective dates. These maxima refer

[8] In G., 1906, Chaps. III and IV, pp. 31–73, will be found an examination of the following sources of error: (1) errors due to the application of Newton's law; (2) errors arising from changes in the value of h (coefficient of thermal conductivity) *during* a measurement; (3) errors due to a lack of equality of the coefficient h for the two actinometric bodies because of the differences of their temperatures; (4) errors due to the changes in the value of solar radiation during a measurement; (5) errors due to lack of exact identity of the two actinometric bodies; (6) errors arising from the unequal influence of secondary sources of heat upon each of the two actinometric bodies; (7) errors depending upon the corrections of the actinometric thermometers; (8) errors of observation due to the inequality of the intervals of time; (9) errors in thermometric readings. For the discussion of pyrheliometric errors see G., 1906, Chap. V, pp. 74–88.

[9] See G., 1906, Chap. VII, pp. 104–112.

[10] These tables, not reproduced here, will be published in one of the forthcoming publications of the Meteorological Bureau of Warsaw.

[11] For the determination of the daily values of the intensity of solar radiation see G. 1906; Chap. VIII.

to the sun's elevation at the middle of each corresponding month; they have not been reduced to the mean distance of the earth from the sun.

As to the annual mean of the solar radiation, this was computed as the mean of the data in column 4, i. e., of the monthly means reduced to an elevation of 30° and at the mean distance, the number of days of observations having been taken as weights for the particular values. In an analogous manner the mean annual absolute humidity has been found from the monthly means and the number n of days of observations as their "weights". From Table 1 it appears that the mean of the five years (1901–1905) at Warsaw is equal to 0.990 gr. cal. (the corresponding mean absolute humidity being 7.0 millimeters).

5. *On the character of the annual march of the total intensity of solar radiation at Warsaw.*—An examination of the annual summaries[12] for Warsaw leads to the conclusion that the annual march of the intensity of radiation at Warsaw presents three maxima, viz:

(*a*) Principal maximum in the spring in the months of April or May.

(*b*) Second maximum in summer, during July.

(*c*) Third maximum in the autumn, always occurring during September.

As to the minimum, it occurs in December or January, altho diminutions in the monthly values also appear in June and August, preceding the maxima of summer and autumn.

These results, plainly visible in each annual summary, notwithstanding the individual differences of each year, are accentuated still more if one computes the monthly means for the whole period 1901–1905, using the data given in Table 1.

These means of the five years 1901–1905, for the consecutive months (I–XII), are as follows:

I....	0.774	IV....	1.176	VII....	1.162	X....	1.000
II....	0.954	V....	1.145	VIII....	1.107	XI....	0.887
III....	1.085	VI....	1.119	IX....	1.124	XII....	0.755

It should be understood, however, that the monthly means thus obtained must not be considered as "normals" for Warsaw, because of a strong depression in the intensity of radiation, which is particularly marked in the middle of the period 1901–1905. We shall speak of this in the following paragraph.

6. *Mean annual summary for the five years 1901–1905 at Warsaw.*—The preceding deductions relative to the annual change of the intensity at Warsaw, apply only in part to the period, which might be called abnormal, from December, 1902, to February, 1904. In fact, on comparing the annual means of the intensity of radiation for the successive years 1901–1905 at Warsaw (see Table 1), one is struck by the strong diminution which occurs in 1903. In that year this diminution of the annual mean reaches about 15 per cent of the mean of the five years, and almost 20 per cent of the average for 1901. This marked depression in the intensity of solar radiation, as is well known, is not at all of a character local to Warsaw, nor to the whole of Poland, but it was observed in other parts of Europe and in America where pyrheliometric or actinometric measurements were made during that period.

Considering the fact of this depression as indisputable and general (as follows from the work of Messrs. H. H. Kimball, S. P. Langley, H. Dufour, R. Holm, M. Marchand, and several other eminent observers), let us point out more precisely its character, according to the monthly and annual tables obtained at Warsaw. The duration of the depression extends from December, 1902 to February, 1904, a total of fifteen months. The values of the radiation were so noticeably diminished at that time that it is possible at once to state the limits of this period.

In order to procure numerical data susceptible of comparison, let us prepare a "mean annual summary" for the period

[12] See curves of monthly variation, fig. 2.

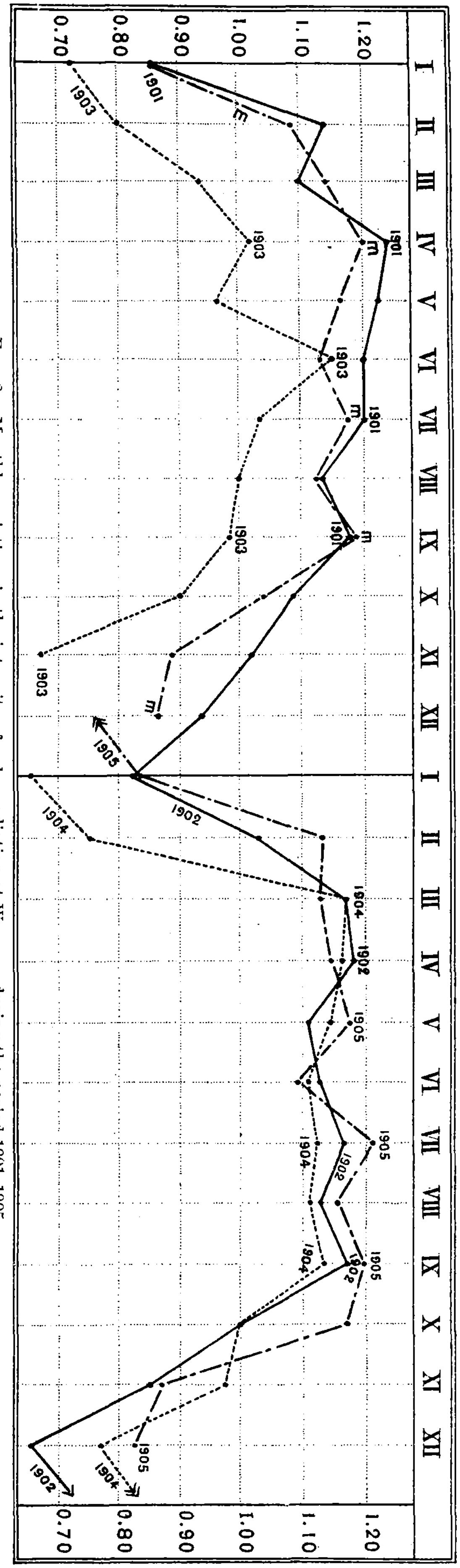

FIG. 2.—Monthly variations in the intensity of solar radiation at Warsaw, during the period 1901–1905.

1901–1905, leaving out the months of this depression. These means are presented in the following Table 2.

TABLE 2.—*Mean annual summary, based on actinometric measurements made at Warsaw during 1901–1905, omitting December, 1902—February, 1904.*

1 Month.	2 Monthly mean. Q	3 h	4 Q 30°; mean distance.	5 n	6 f	7 Max. Q
		°				
I	0.829*	17	1.010	14	3.0	0.937
II	1.082	25	1.126	12	2.7*	1.242
III	1.140	36	1.063	18	3.8	1.324
IV	1.135	47	1.047	19	5.4	1.320
V	1.164	56	0.998	48	7.0	1.346
VI	1.118	61	0.944	32	9.1	1.294
VII	1.173	59	1.008	35	9.7	1.328
VIII	1.119	51	0.975	31	10.3	1.269
IX	1.159	41	1.063	32	8.0	1.367
X	1.036	29	1.042	15	6.8	1.241
XI	0.887	20	1.018	15	3.6	1.049
XII	0.862	15	1.088	7	4.2	0.975
Mean			1.017	278	7.1	

The monthly means, Q, of the "*mean annual summary*" (Table 2) are represented graphically in curve m, fig. 2; the curves for each of the consecutive years 1901–1905 are presented in the same figure by lines that are numbered for the consecutive years and that are based on the data of Table 1, column 2.

7. *On the march of the depression of solar radiation as observed at Warsaw.*—By comparing the monthly values of the period December, 1902, to February, 1904, (see Table 1) with the annual summary, Table 2, it is seen that—

(*a*) The depression is suddenly emphasized in the month of December, 1902, giving at Warsaw from its beginning, a value about 20 per cent lower than those of the mean annual summary.

(*b*) On account of this great depression the whole annual march of the intensity of solar radiation in 1903 undergoes a perturbation which has masked, or even changed, the usual variation of radiation, during that year at Warsaw.

(*c*) This depression, persisting from the month of December, 1902, until the month of February, 1904, inclusive, and giving a mean diminution of intensity exceeding 15 per cent at Warsaw, has not had a uniform character in its march, but on the contrary has presented several oscillations.

(*d*) After a sharp and large diminution in December, 1902, and after the particularly low values of the intensity in the months of February and March, 1903, a certain weakening of this depression is marked toward the beginning of the summer of 1903; the values for June of that year at Warsaw are relatively quite high. But in July, and in the following months until October the depression very clearly increases up to about 15 per cent.

(*e*) The end of 1903, as likewise the months of January and February, 1904, present anew a large increase in the depression, and the values of intensity observed during these months seem even lower than at the beginning of 1903. Thus the month of February, 1904, gives values diminished by more than 30 per cent. The depression ends in the same month, in a manner as abrupt as its beginning.

8. *Duration of insolation in hours and total quantity of heat in gram calories at Warsaw during the years 1903, 1904, and 1905.*—This profound perturbation in the intensity of solar radiation as it reaches the surface of the earth may have given rise to important meteorological results. The question as to the influence will be of the highest interest and will necessitate special research, altho the problem presents great difficulties and complications. We add that the study of this question has been already begun in an important memoir, by S. P. Langley, published in the Astrophysical Journal.[13]

[13] S. P. Langley. On a possible variation of the solar radiation, and its probable effect on terrestrial temperature. (Astrophysical Journal, vol. 19, pp. 305–321.)

We shall limit ourselves simply to indicating the duration of insolation at Warsaw, and the sums of heat for the three consecutive years 1903, 1904, and 1905. (See Table 3 and Table 4.) The sums of heat have been calculated[14] from combined readings of heliographs [sunshine recorders] and actinometers; they are exprest in gram-calories per square centimeter of horizontal surface.

TABLE 3.—*Duration of insolation at Warsaw.*

Year.	Winter. I, II, XII.	Spring. III, IV, V.	Summer. VI, VII, VIII.	Autumn. IX, X, XI.	Annual.
	Hours.	*Hours.*	*Hours.*	*Hours.*	*Hours.*
1903	114.9	353.5	462.7	314.3	1245.4
1904	101.7	508.4	849.0	331.5	1790.6
1905	164.9	424.8	754.6	218.6	1562.9

TABLE 4.—*Sums of heat in gram-calories per square centimeter of horizontal surface at Warsaw.*

Year.	Winter. I, II, XII.	Spring. III, IV, V.	Summer. VI, VII, VIII.	Autumn. IX, X, XI.	Annual.
	gr. cal.	*gr. cal.*	*gr. cal.*	*gr. cal.*	*gr. cal.*
1903	1340	10810	17300	7440	36890
1904	930	16190	28960	8150	54230
1905	1910	15760	27790	5460	50920

Taking 3550 hours as the maximum of the possible duration of insolation at Warsaw (which can be registered by heliographs [sunshine recorders] of the Stokes-Campbell type), we find that the actual duration was, in 1903, equal to 35 per cent of the possible maximum duration, while in 1904 there was 50 per cent, and in 1905, 44 per cent of that same possible duration.

The year 1903 presents also a considerable deficiency in respect to the sums of heat, in comparison with the years 1904 and 1905. We find[15] that if the sky were constantly clear the sums in question for the four seasons would be, at Warsaw, 7900, 35,700, 45,000, and 18,200; the total for the whole year would thus be 106,800 gr. cal. per cm.^{2} of horizontal surface. Table 3 shows that in 1903 the ratio of the actual sums received to the theoretical sums is only 35 per cent, whereas in 1904 it is 51 per cent, and in 1905 it is 48 per cent.

THE "SOUTHWEST" OR "WET" CHINOOK.

By H. BUCKINGHAM, sr. Dated Lawton, Okla., March 19, 1907.

In the winter of 1851 I spent a couple of months on Queen *Charlotte Island, off the British American coast, sailing from* Puget Sound on a gold hunting voyage. I think we sailed from the Sound early in January. We went about half-way (I should think) up the island, and entered Gold Harbor (on the west side). We went east about 12 miles to the head of the harbor and anchored for the winter. We prospected for gold for some two months.

On the 30th of March the chinook winds set in and the snow melted with great rapidity. When we entered the island the only snow we saw was on the coast. East of us was a mountain of rock, I should think 30 miles from the head of the bay. It appeared 10,000 feet high, and was bare when we came in sight of it; but in a couple of weeks it was covered with snow.

After the chinook wind, which appeared to come from the southwest—we took it for granted it was the Japan current—had blown for twenty-four hours it seemed as if the water was leaping from every mountain top. The roar of it was something like Niagara, tho not so deep, as the water was scattered, so to speak.

On the 1st of April we raised anchor, and at 4 p. m. were in

[14] We can not here enter into the details of these calculations. See G. 1906. Chap. XI, pp. 167–186.

[15] According to the "mean" monthly values of the intensity in 1901–1905. See G. 1906; Chap. XI, pp. 172–176.